REMARKS

The present invention is a method for constructing a reservoir model representative of an underground reservoir, including discretizing said reservoir by a set of grid cells, and associating with said reservoir model a permeability field constrained by *a priori* geologic data and dynamic data collected in said reservoir by measurements and observations. The method constructs an initial reservoir model including generating a permeability field in accordance with stochastic model coherent with the *a priori* data; identifies zones inside said reservoir; calculates effective permeabilities of said zones and carries out, by means of a simulator, a simulation of fluid flows to estimate corrections to be brought to said effective permeabilities to improve calibration relation to said dynamic data; and propagates said corrections to said set of grid cells to said reservoir model, by means of an iterative optimization process comprising minimizing a function which depends on said correction using a technique of gradual deformation of utilizations of said stochastic model.

At the outset, it is noted that the Examiner has observed in Section 3 of the Office Acton that the drawings only contain French labels, the Abstract is not of a proper format, and finally, that page 6 of the claims inserted by Preliminary Amendment is missing from the application. It is apparent that the U.S. PTO has misplaced a substantial part of Applicants' Preliminary Amendment filed on July 10, 2003. Attached hereto is a postcard receipt showing filing of the Preliminary Amendment. The Amendment included an Abstract on page 27 as submitted and in the copy of the Preliminary Amendment herewith, a new set of drawings which contain English language text located after page 27 as submitted and in the copy of

the Preliminary Amendment herewith and on page 25 of the Preliminary Amendment as submitted and herewith which contained claims 20-24. The foregoing materials are in Applicant's file.

The Substitute Specification has been amended to improve its form for reexamination.

Newly submitted claims 27-42 have been drafted to overcome the various stated grounds of objection and rejection. Claim 27 recites:

> A method for constructing a reservoir model representative of an underground reservoir, including discretizing said reservoir by a set of grid cells, and associating with said reservoir model a permeability field constrained by a priori geologic data and dynamic data collected in said reservoir by measurements and observations comprising:
>
> a) constructing an initial reservoir model including generating a permeability field in accordance with a stochastic model, coherent with the a priori geologic data;
>
> b) identifying zones inside said reservoir;
>
> c) calculating effective permeabilities of said zones and carrying out, by means of a simulator, a simulation of fluid flows, to estimate corrections to be brought to said effective permeabilities to improve calibration in relation to said dynamic data; and
>
> d) propagating said corrections to said set of grid cells of said reservoir model, by means of an iterative optimization process comprising minimizing a function which depends on said correction, using a technique of gradual deformation of realizations of said stochastic model.

The original claims were rejected as being based upon an insufficient disclosure pertaining to identifying zones inside the reservoir which is step b of claim 27. This subject matter is supported in numerous places in the Substitute Specification. See paragraph [0030] "[f]or example, for a well test simulator, rings of increasing radius, centered on the wells can be selected to define zones"; see paragraph [0031], "[t]he zones considered here are determined by the streamlines themselves"; see paragraph [0032], "[a] line or a set of streamlines define a zone";

see paragraph [0038] "[t]he zones corresponding to the various streamline groups", and see paragraph [0055]; "[s]treamlines actually appear to be a very natural tool for defining zones"; "[f]or example, the information relative to the various zones can be provided by test wells...effective permeability can in this case be calculated as a function of the radius of investigation around the well; the zones considered are then rings"; and "[f]low simulation allows to identify zones". It is submitted that the foregoing disclosure in numerous places in the specification enables a person of ordinary skill in the art to practice the step "identifying zones inside said reservoir" as set forth step b) in newly submitted claim 27 without undue experimentation.

Additionally, it is noted that the Examiner rejected claim 7, which corresponds to newly submitted claim 28, which recites: "wherein said zones are defined either manually or automatically from said flow simulator". It is submitted that the aforementioned portions of the specification and the remainder of the specification, including paragraph [0021], provide a person of ordinary skill in the art with sufficient information to either manually or automatically define the zones from the flow simulator without undue experimentation.

As indicated above, newly submitted claims 27-42 have been drafted to overcome the additional stated grounds of indefiniteness pertaining to claims 6 and 7 with these rejections now being moot.

Claims 6-19 and 25-26 stand rejected under 35 U.S.C. §101 as allegedly not claiming statutory subject matter. The Examiner concludes that claim 6 "lacks a useful, concrete, and tangible result" and further, that "[t]he claim is directed to manipulation of ideas that are abstract in nature, as performing of the method does not result in an outcome, that is, for example, displayed, stored, etc., by means of a

tangible medium...there is no tangible result, the claim is non-statutory". This ground of rejection is traversed for the following reasons.

A reservoir model is known to be a model of the subsoil of the geologic underground. The models of a set of objects representing the rock constituting the earth as, for example, described at the end of paragraph [0027] of the Substitute Specification, to preserve "the coherence of the permeability value distributed in relation to the spatial variability model" and in paragraph [0032] of the Substitute Specification that the objective of the first part, as recited in steps a), b) and c), is to "describe the geometry of the streamlines and to identify the modification to be applied to the effective permeability of these lines so as to better calibrate the production data" (emphasis added). Calibration of production data has utility, is tangible and is concrete.

The Examiner is directed to MPEP 2106, Sections (a)-(c), defining what is meant by a useful, tangible and concrete result to which the Examiner refers in the rejection.

A useful result is defined in section (a), as something that has utility as required by 35 U.S.C. §101. The claimed method for constructing a reservoir model representative of an underground reservoir has substantial utility as recognized throughout the field of petroleum development of reservoirs. In this regard, paragraph [0001] of the Substitute Specification defines the invention as relating to "a method of constraining stochastic models representing heterogeneous underground zones, such as oil reservoirs to data referred to as dynamic data because they vary with fluid displacements which data, for example, are production data or pressure data obtained from test wells (emphasis added). Clearly the use of

test wells in the development of petroleum reservoirs and "production or pressure data" is recognized by everyone in the field of petroleum exploration as having utility.

Paragraph [0027] describes the traditional calibration of reservoir models which are extremely important in the development of petroleum resources. Reservoir models are real world tools for controlling development and production of petroleum resources which are the antithesis of abstract ideas that characterize non-statutory subject matter.

Furthermore, paragraph [0055] of the Substitute Specification discusses streamline flow simulations which are described as "a very natural tool for defining zones" which pertains to development of and production from petroleum reservoirs. Furthermore, the statement in paragraph [0055] that "[f]rom the present invention involving identification of zones and calculation of effective permeabilities for these zones, this choice seems to be logical" again suggests real world use in development and production from petroleum reservoirs.

Finally, paragraph [0055] states that information relative to the various zones can be provided by test wells, that the effective permeability can, in this case, be calculated as a function of the radius of investigation around the wells, and that the flow simulator used for well test simulation can be a standard flow simulator all of which relate to real world parameters involved in the modeling of the reservoir used for development and production. Therefore, it is seen that the claimed invention clearly has utility pursuant to 35 U.S.C. §101.

MPEP Section 2106(b) defines a tangible result as "not necessarily mean[ing] that a claim must either be tied to a particular machine or apparatus or must operate to change articles or materials to a different state or thing" with it further being said

that "the process claim must set forth a practical application if a judicial exception is recited "to produce real world result" (emphasis added). Claim 27 recites a method for constructing a reservoir model representative of an underground reservoir including steps of constructing an initial reservoir model; identifying zones inside the reservoir; calculating effective permeabilities of the zones; and propagating corrections to the set of grid cells of the reservoir model. Such steps are tied to, as recited in the claim, "*a priori* geological data" and "dynamic data" collected in said reservoir by measurements and observations all of which pertain to a real world application involving data acquisition from a reservoir. The claimed construction of reservoir model, which is based upon collected real world data, has real world applications which are a basic tool in hydrocarbon exploration and production which is a "practical application" required by the MPEP to be a tangible result.

For example, persons skilled in the art understand that the location of an injection well, the location of a production well, the composition of the injected fluid, the pressure of the injected fluid and the type of apparatus used to pump and separate hydrocarbons are all based upon a reservoir model.

Finally, the requirement in MPEP 2106 step (c) pertaining to what is a "concrete result" requires the claims to provide a repeatable and predictable result. That, of course, is the essence of the claimed invention since the model is intended to provide the person skilled in the art with a tool, as described above, useful for forming a model representative of the permeability of a heterogeneous medium, discretized by a grid, such as an underground zone, constrained by *a priori* geological data and dynamic data collected in the medium by means of measurements and observations obtained beforehand as described in

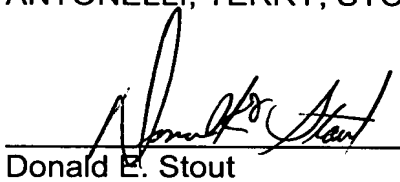
paragraph [0020] of the Substitute Specification. Accordingly, it is submitted that the claimed method for constructing a reservoir model pursuant to claims 27-42 also produces a concrete result.

In view of the foregoing amendments and remarks, it is submitted that each of the claims in the application is in condition for allowance. Accordingly, early allowance thereof is respectfully requested.

To the extent necessary, Applicants petition for an extension of time under 37 C.F.R. §1.136. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account No. 01-2135 (612.42904X00) and please credit any excess fees to such Deposit Account.

Respectfully submitted,

ANTONELLI, TERRY, STOUT & KRAUS, LLP



Donald E. Stout
Registration No. 26,422
(703) 312-6600

DES:dlh

Patent Dkt. No. 612.42904X00 Attorney Initials DES/alb

Application No. _____ Filing Date July 10, 2003

Applicant(s) LE RAVALEC-DUPIN, et al.

Papers Filed Herewith on July 10, 2003

Receipt is hereby acknowledged of the papers filed as indicated by the checked items in connection with the above-identified application:

- ☒ New Application Transmittal Form
  - 22 Pages of Specification (5 claims)
  - 1 Sheets of Drawings (Figs. 1-2)
- ☐ Declaration (___ pages)
- ☒ Fee Transmittal Form
- ☒ Claim for Priority
  - ☒ Priority Documents
- ☐ Assignment Papers
- ☐ Issue Fee Transmittal
- ☐ Other _____
- ☒ Credit Card Payment Form
  - Fees $ 768.00
- ☒ Amendment Preliminary w/sub. spec & marked-up copy
- ☐ Response to Office Action
- ☐ Petition for Extension of Time (___ mos.)
- ☒ Information Disclosure Statement
  - ☒ PTO-1449 ☒ Copies of References
- ☐ Revised Drawings (___ sheets)
- ☐ Notice of Appeal

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PATENT & TRADEMARK OFFICE

612.42904X00

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: RAVALEC-DUPIN et al.

Application No.: Unassigned

Filed: July 10, 2003

For: METHOD OF CONSTRAINING A HETEROGENEOUS PERMEABILLITY FIELD REPRESENTING AN UNDERGROUND RESERVOIR BY DYNAMIC DATA

Art Unit: Unassigned

Examiner: Unassigned

PRELIMINARY AMENDMENT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

July 10, 2003

Sir:

Prior to examination of the above-identified application, please amend the specification and claims as follows:

IN THE SPECIFICATION:

A Substitute Specification is submitted herewith. The amendments to the specification are indicated in a photocopy of the original specification attached hereto. It is submitted that the amendments do not introduce new matter.

IN THE CLAIMS:

Prior to calculation of the filing fee, please cancel claims 1-5 without prejudice or disclaimer and add new claims 6-26 as follows:

6) A method for forming iteratively a model representative of a permeability field of a heterogeneous medium, discretized by a grid pattern, constrained by a priori geologic data and dynamic data collected in the medium by measurements and observations obtained beforehand, comprising:

a first stage comprising generating an initial model of the permeability in accordance with a Gaussian or related stochastic model, coherent with the a priori geologic data, and carrying out, a simulation of the fluid flows and identifying zones inside the reservoir, calculating effective permeabilities of the identified zones and, from results of the simulation, estimating corrections to be made to the effective permeabilities to improve calibration in relation to the data, and

a second stage comprising propagating the corrections to a whole of grid cells of the permeability field, by means of an iterative optimization process comprising minimizing a function which quantifies a difference between the effective permeabilities required to obtain the calibration and the effective permeabilities calculated for the considered permeability field, using a technique of gradual deformation of realizations of the stochastic model.

7) A method as claimed in claim 1, wherein:

the zones are defined either manually or automatically from the simulation of the fluid flows.

8) A method as claimed in claim 6, wherein:

simulation of the fluid flow is carried out by a streamline simulator and the identified zones of the medium are identified by a set of grid cells traversed by at least one streamline of fixed geometry.

9) A method as claimed in claim 7, wherein:

simulation of the fluid flow is carried out by a streamline simulator and the identified zones of the medium are identified by a set of grid cells traversed by at least one streamline of fixed geometry.

10) A method as claimed in claim 6, wherein:

zones are identified as volume portions on a periphery of wells running through the medium, within a framework of well tests.

11) A method as claimed in claim 7, wherein:

the identified zones are identified as volume portions of a periphery of wells running through the medium, within a framework of well tests.

12) A method as claimed in claim 8, wherein:

the identified zones are identified as volume portions on a periphery of wells running through the medium, within a framework of well tests.

13) A method as claimed in claim 9, wherein:

the identified zones are identified as volume portions on a periphery of wells running through the medium, within a framework of well tests.

14) A method as claimed in claim 6, wherein:

at least one gradual deformation parameter is assigned to each of identified zones.

15) A method as claimed in claim 7, wherein:

at least one gradual deformation parameter is assigned to each of said identified zones.

16) A method as claimed in claim 8, wherein:

at least one gradual deformation parameter is assigned to each of said identified zones.

17) A method as claimed in claim 9, wherein:

at least one gradual deformation parameter is assigned to each of said identified zones.

18) A method as claimed in claim 10, wherein:

at least one gradual deformation parameter is assigned to each of said identified zones.

19) A method as claimed in claim 11, wherein:

at least one gradual deformation parameter is assigned to each of said identified zones.

20) A method as claimed in claim 12, wherein:

at least one gradual deformation parameter is assigned to each of said identified zones.

21) A method as claimed in claim 13, wherein:

at least one gradual deformation parameter is assigned to each of said identified zones.

22) A method as claimed in claim 6, wherein:

the medium is an underground zone.

23) A method as claimed in claim 7, wherein:

the medium is an underground zone.

24) A method as claimed in claim 8, wherein:

the medium is an underground zone.

25. (New) A method as claimed in claim 10, wherein:

the medium is an underground zone.

26. (New) A method as claimed in claim 14, wherein:

the medium is an underground zone.

REMARKS

The specification and claims have been amended to improve their form for examination.

Please charge any shortage in fees due in connection with the filing of this paper to Deposit Account No. 01-2135 (Case No. 612.42904X00) and please credit any excess fees to such Deposit Account.

Respectfully submitted,

ANTONELLI, TERRY, STOUT AND KRAUS, LLP

Donald E. Stout
Registration No. 26,422

DES/nbf
Attachment